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ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS **122**, iii–viii (1967)

Contents for Volume 122

NUMBER 1, OCTOBER 1967

SUSAN A. CARPENTER AND LEWIS B. BARNETT. Location of Cellulase Activity in *Cellvibrio gilvus* 1

JOHN F. ROBYT AND DEXTER FRENCH. Multiple Attack Hypothesis of α-Amylase Action: Action of Porcine Pancreatic, Human Salivary and *Aspergillus oryzae* α-Amylases 8

J. W. DONOVAN, J. G. DAVIS, AND L. U. PARK. Sugar Nucleotides of Chicken Egg White 17

CHARLES H. BLOMQUIST. Structural Changes Associated with the Acid Inactivation of Horse Liver Alcohol Dehydrogenase 24

S. S. STIVALA, L. YUAN, J. EHRLICH, AND P. A. LIBERTI. Physicochemical Studies of Fractionated Bovine Heparin. III. Some Physical Parameters in Relation to Biological Activity 32

SALVATORE S. STIVALA AND PAUL A. LIBERTI. Physicochemical Studies of Fractionated Bovine Heparin. IV. Cu(II) Binding in Relation to pH, Molecular Weight, and Biological Activity 40

ARTHUR A. SPECTOR. Effect of Carnitine on Free Fatty Acid Utilization in Ehrlich Ascites Tumor Cells 55

WILLIAM B. RATHBUN. γ-Glutamyl-Cysteine Synthetase from Bovine Lens. I. Purification and Properties 62

WILLIAM B. RATHBUN. γ-Glutamyl-Cysteine Synthetase from Bovine Lens. II. Cysteine Analogue Studies 73

DAROLD WOBSCHALL AND DORITA A. NORTON. Absorption Spectra and Formation Constants of Steroid-Iodine Complexes 85

W. J. VISEK, M. E. IWERT, N. S. NELSON AND J. H. RUST. Some Immunologic Properties of Jackbean Urease and Its Antibody 95

HERBERT W. DICKERMAN AND BETTY CHINN SMITH. Aminoacyl $tRNA_{met}$ Transformylase II. Evidence for an Enzyme: tRNA Complex 105

M. CRAIG PINSKER AND WILLIAM L. WILLIAMS. Properties of a Spermatozoan Antifertility Factor 111

J. RUIZ-HERRERA. Chemical Components of the Cell Wall of *Aspergillus* Species 118

D. A. HAYDON AND G. V. F. SEAMAN. Electrokinetic Studies on the Ultrastructure of the Human Erythrocyte. I. Electrophoresis at High Ionic Strengths—the Cell as a Polyanion 126

ROBERT M. METRIONE, ROBERT B. JOHNSTON, AND RICHARD SENG. Purification, Partial Characterization, and Sequence Around a Reactive Sulfhydryl of Ficin 137

SAKAE KATOH AND ANTHONY SAN PIETRO. Ascorbate-Supported NADP Photoreduction by Heated *Euglena* Chloroplasts 144

SAMUEL T. LIM AND JEAN BOTTS. Temperature and Aging Effects on the Fluorescence Intensity of Myosin-ANS Complex 153

JEAN-CLAUDE JATON AND HANNA UNGAR-WARON. Antibodies to Folic Acid and Methotrexate Obtained with Conjugates of Synthetic Polypeptides 157

R. E. Huber and R. S. Criddle. Comparison of the Chemical Properties of Selenocysteine and Selenocystine with Their Sulfur Analogs 164
C. A. Woolfolk and E. R. Stadtman. Regulation of Glutamine Synthetase. IV. Reversible Dissociation and Inactivation of Glutamine Synthetase from *Escherichia coli* by the Concerted Action of EDTA and Urea 174
L. Vázquez-Colón and Tsoo E. King. Interchain Interactions of the Respiratory Chain in Cardiac Muscle: Succinate Oxidase 190
E. L. Pugh and B. L. Horecker. Function of Tyrosine Residues in Rabbit Muscle Aldolase 196
Martin Poe, H. Gutfreund, and Ronald W. Estabrook. Kinetic Studies of Temperature Changes and Oxygen Uptake in a Differential Calorimeter: The Heat of Oxidation of NADH and Succinate 204
Gordon Guroff and John Daly. Quantitative Studies on the Hydroxylation-Induced Migration of Deuterium and Tritium During Phenylalanine Hydroxylation. 212
John Daly, Gordon Guroff, Sidney Udenfriend, and Bernhard Witkop. Hydroxylation-Induced Migrations of Tritium on Several Substrates of Liver Aryl Hydroxylases 218
John A. Anderson and Pill-Soon Song. Borohydride Reduction of Aspartate Aminotransferase and Model Compounds 224
Elizabeth L. Gross and Lester Packer. Ion Transport and Conformational Changes in Spinach Chloroplast Grana. II. Light-Induced Changes 237

COMMUNICATIONS

C. E. Bodwell. Two Subunits of Tropomyosin B 246
Charles H. Blomquist, David A. Smith, and Aaron M. Martinez. Evidence for the Dissociation of Horse Liver Alcohol Dehydrogenase into Subunits in the Presence of Detergent 248
Robert L. McGeachin, Betty Ann Potter, and Robert M. Atherton. Inhibition of Amylase Synthesis in the Perfused Rat Liver by Fructose and Its Metabolites 251
Patrick J. Dunphy, David L. Gutnick, Philip G. Phillips, and Arnold F. Brodie. Naturally Occurring Isomers of a Bacterial Menaquinone 252
David F. Wilson. The Near Infra-red Electronic Spectra of Non-heme Iron Proteins at −196° 254
David W. Russell and Eric E. Conn. The Cinnamic Acid 4-Hydroxylase of Pea Seedlings 256
V. R. Usdin, M. A. Mitz, and P. J. Killos. Inhibition and Reactivation of the Catalytic Activity of Thermal α-Amino Acid Copolymer 258
H. W. Siegelman, D. J. Chapman, and W. J. Cole. Enzymatic Cleavage of Phycocyanobilin 261
Errata 262
List of Forthcoming Papers 263

Number 2, November 1967

Robert L. McGeachin, Betty Ann Potter, and Charlotte W. Wilson. Effect of Nitrophenols and Nitrobenzoic Acids on Amylase Synthesis and Transport in the Perfused Rat Liver 265
A. O. A. Miller. Characterization of Messenger Ribonucleic Acid in Partially Synchronized HeLa Cells 270

Ludwig Kornel, Ralph E. Schrohenloher, and Robert C. Caldwell. Isolation from Plasma of an α_1-Glycoprotein Resembling "Orosomucoid." A Simple Method for Its Estimation in Blood and Tissues 280
Frank R. Dastoli and Steven Price. Further Studies on Xanthine Oxidase in Nonpolar Media 289
Marcel E. Nimni, Kalindi Deshmukh, and Lucien A. Bavetta. Turnover and Age Distribution of a Collagen Fraction Extractable from Rat Skin by Mercaptoethylamine 292
Hiroshi Hyodo and Ikuzo Uritani. Properties of Polyphenol Oxidases Produced in Sweet Potato Tissue after Wounding 299
Y. Israel and I. Salazar. Inhibition of Brain Microsomal Adenosine Triphosphatases by General Depressants 310
J. D. Termine, I. Pullman, and A. S. Posner. Electron Spin Resonance Study of Irradiated Bone and Its Constituents 318
Jan Hermans, Jr. and Lillian Wan Lu. Reactivity of the Individual Tyrosine Side Chains of Myoglobin Toward Iodination 331
Robert N. Feinstein, George A. Sacher, Judith B. Howard, and Joann T. Braun. Comparative Heat Stability of Blood Catalase 338
Oscar W. Portman, Manfred Alexander, and Cesar A. Maruffo. Composition of Subcellular Constituents of Aortic Intima plus Inner Media Isolated by Differential and Density Gradient Centrifugation 344
Hava Neumann and Roberts A. Smith. Cleavage of the Disulfide Bonds of Cystine and Oxidized Glutathione by Phosphorothioate 354
H. G. Windmueller and Albert E. Spaeth. *De Novo* Synthesis of Fatty Acid in Perfused Rat Liver as a Determinant of Plasma Lipoprotein Production 362
W. Manson. Reaction of Basic Dyes with α_s- and β-Casein 370
Hiroshi Kumaoka and Gene M. Brown. Biosynthesis of Thiamine. VI. Incorporation of Formate into Carbon Atom Two of the Pyrimidine Moiety of Thiamine 378
A. Bekierkunst and A. Bricker. Studies on the Mode of Action of Isoniazid on Mycobacteria 385
Frank Marcus. Kidney Fructose 1,6-Diphosphatase. Purification and Studies on Desensitization to Adenosine 5′-Monophosphate Inhibition 393
T. R. Koszalka. Extrahepatic Creatine Synthesis in the Rat. Role of the Pancreas and Kidney 400
C. Little and P. J. O'Brien. Products of Oxidation of a Protein Thiol Group after Reaction with Various Oxidizing Agents 406
Masaaki Ashida and Eiji Ohnishi. Activation of Pre-Phenol Oxidase in Hemolymph of the Silkworm, *Bombyx mori* 411
F. Melani, M. Farnararo, and G. Sgaragli. A Kinetic Study of Rat Kidney Alkaline Phosphatase 417
Andrés J. Jobbágy. Altered Aspartate Transcarbamylase of *Neurospora crassa* Responsible for a Suppressor Effect 421
A. G. Dawson, F. J. R. Hird, and D. J. Morton. Oxidation of Leucine by Rat Liver and Kidney 426
A. Previero, M-A. Coletti-Previero, and Cl. Axelrud-Cavadore. Prevention of Cleavage Next to Tryptophan Residues during the Oxidative Splitting by *N*-Bromosuccinimide of Tyrosyl Peptide Bonds in Proteins 434
Morris London, Jeanne Fuld, Eleanor Crane, and Jesse H. Marymont, Jr. Concentration of Biochemical Compounds in Charged Hydrating Systems 439
O. Hechter, K. Yoshinaga, I. D. K. Halkerston, and K. Birchall. Estrogen-

Like Anabolic Effects of Cyclic 3′,5′ Adenosine Monophosphate and other Nucleotides in Isolated Rat Uterus 449
P. V. Subba Rao, K. Moore, and G. H. N. Towers. *O*-Pyrocatechuic Acid Carboxy-Lyase from *Aspergillus niger* 466
Laura Shen and Victor Ginsburg. Sugar Analysis of Cells in Culture. Determination of the Sugars of HeLa Cells by Isotope Dilution 474
S. F. Yang. Biosynthesis of Ethylene. Ethylene Formation from Methional by Horseradish Peroxidase 481
D. J. Vonderschmitt, Karin Smith Vitols, F. M. Huennekens, and K. G. Scrimgeour. Addition of Bisulfite to Folate and Dihydrofolate 488
Robley J. Light. Effects of Cycloheximide and Amino Acid Analogues on Biosynthesis of 6-Methylsalicylic Acid in *Penicillium patulum* 494
M. G. Mustafa and Tsoo E. King. Wurster's Blue Mediated Oxidation of NADH and Phosphorylation in Mitochondria 501
Kozo Utsumi and Lester Packer. Uncoupling of Energy Transfer Reactions in Mitochondria by Tetraphenyl Boron 509

COMMUNICATIONS

John P. Robinson. Effect of Arginine on Antibody-Antigen Interaction 516
R. A. Chaplain. Thermal Motion as the Rate-Limiting Step in the Superprecipitation of Actomyosin Gels 518
J. J. Holbrook and Renate Jeckel. Reversible, Covalent Modification of the Essential Cysteine Residues of Pig Heart Lactate Dehydrogenase 519
R. H. Locker and C. J. Hagyard. Variations in the Small Subunits of Different Myosins 521
Masanobu Tokushige, Osamu Hayaishi, and Katsura Morita. Reactivating Effect of Some Naturally Occurring Dithiol Compounds on Threonine Deaminase 522
S. S. Hotta. Dependence of Amytal Inhibition of Glutathione Reduction and Hexosemonophosphate Shunt on Brain Preparation 524
Erratum 526
List of Forthcoming Papers 527

Number 3, December 1967

Paul A. Weinhold and Laurens Anderson. Metabolism of *myo*-Inositol in Animals. III. Action of the Antagonist 2-O,*C*-Methylene-*myo*-Inositol 529
Morris A. Johnson and LeMar F. Remmert. Solubilization of a Possible Intermediate of Oxidative Phosphorylation from Cabbage Mitochondria 537
Rody P. Cox and Martin J. Griffin. Alkaline Phosphatase. I. Comparison of the Physical and Chemical Properties of Enzyme Preparations from Mammalian Cell Cultures, Various Animal Tissues, and *Escherichia coli* 552
D. M. Ciment and W. C. Overend. Examination of the Effect of γ-Rays on Deoxyribonucleic Acids 563
George R. Morrison. Hexokinase and Glucokinase Activities in Bile Duct Epithelial Cells and Hepatic Cells from Normal Rat and Human Livers 569
B. H. J. Hofstee. "Renaturation" of Chymotrypsinogen A Heated in 8 M Urea 574
James D. Finkelstein. Methionine Metabolism in Mammals. Effects of Age, Diet, and Hormones on Three Enzymes of the Pathway in Rat Tissues 583
Jacob Sacks, William D. Duckett, Sallye Morgan, and Margaret Schaefer. Free and Bound Nucleotides in Frog and Mammalian Muscle 591

F. Winterberg. Some Theoretical Considerations on the Inhibition of Tumor Growth by Ultrastrong Magnetic Fields 594
Thomas R. Henderson, David M. Dacus, and Rogene F. Henderson. Deuterium Isotope Effects on Histone Synthesis in Avian Erythroblasts 599
G. V. F. Seaman, L. J. Jackson, and G. Uhlenbruck. Action of α-Amylase Preparations and Some Proteases on the Surface of Mammalian Erythrocytes 605
Elnora H. Smith and Robert E. Beyer. Effect of Potassium and Valinomycin on Oxidative Phosphorylation in Intact Beef Heart Mitochondria and Submitochondrial Particles 614
A. W. Rodwell, S. Razin, S. Rottem, and M. Argaman. Association of Protein and Lipid in *Mycoplasma laidlawii* Membranes Disaggregated by Detergents 621
Tung-Yue Wang. Nonhistone Chromatin Proteins from Calf Thymus and Their Role in DNA Biosynthesis 629
Rapier H. McMenamy and Yong Lee. Microheterogeneity in Albumin: A Contaminant 635
Yoon Soo Kim and John P. Lambooy. Use of a Riboflavin Homolog in the Reduction of Succinic Dehydrogenase Activity in Tissues of Healthy Rats 644
Gale W. Rafter. Further Studies on the Acid-Labile Bound Phosphoserine of *Escherichia coli* 648
R. S. Rosenfeld, Inge Paul, and Tatsuo Yamauchi. Sterol Esterification in Feces 653
M. Canessa-Fischer, F. Zambrano, and V. Riveros-Moreno. Properties of the ATPase System from the Sheath of Squid Giant Axons 658
T. Santoro and G. Stotzky. Effect of Electrolyte Composition and pH on the Particle Size Distribution of Microorganisms and Clay Minerals as Determined by the Electrical Sensing Zone Method 664
Kiyoshi Sunaga and S. S. Koide. Factors Influencing the Interaction of Steroids with Calf Thymus Histones 670
G. A. Mross and R. F. Doolittle. Amino Acid Sequence Studies on Artiodactyl Fibrinopeptides II. Vicuna, Elk, Muntjak, Pronghorn Antelope, and Water Buffalo 674
Koki Horikoshi and Roy H. Doi. Synthesis of *N*-Formylmethionyl-sRNA by *Bacillus subtilis* Extracts 685
Sohair Abdel-Aziz Mostafa and W. W. Umbreit. Inhibition of Ribosomal Polyphenylalanine Synthesis by Soluble Fractions from *Escherichia coli* B 694
Esther N. Zendzian and Eric A. Barnard. Distributions of Pancreatic Ribonuclease, Chymotrypsin, and Trypsin in Vertebrates 699
Esther N. Zendzian and Eric A. Barnard. Reactivity Evidence for Homologies in Pancreatic Enzymes 714
W. Cammer and R. W. Estabrook. Respiratory Activity of Adrenal Cortex Mitochondria during Steroid Hydroxylation 721
Wendy Cammer and Ronald W. Estabrook. Spectrophotometric Studies of the Pigments of Adrenal Cortex Mitochondria 735
Arnold Marglin and R. B. Merrifield. Isolation of A- and B-Chain Sulfonates of Insulin by Countercurrent Distribution 748
Stanley Meizel and Clement L. Markert. Malate Dehydrogenase Isozymes of the Marine Snail, *Ilyanassa obsoleta* 753
D. W. Allmann, R. A. Harris, and D. E. Green. Site of Action of Atractyloside in Mitochondria. II. Inhibition of Oxidative Phosphorylation 766
Paul V. Benko, Trudy C. Wood, and Irwin H. Segel. Specificity and Regulation of Methionine Transport in Filamentous Fungi 783

COMMUNICATIONS

Robert E. Rhoads, John J. Hutton, Jr., and Sidney Udenfriend. Factors Which Stimulate Collagen Proline Hydroxylase 805
Lee Clark, Harold Helbock, and Paul Saltman. The Effect of Metabolic Environment and Chelators on Thiourea Transport by Rat Intestine 807
Charles W. Sharp, Bruce Mackler, H. C. Douglas, Graham Palmer, and S. P. Felton. Studies of an Electron Transport Particle from *Candida utilis* 810
List of Forthcoming Papers 813
Author Index 814
Subject Index 816

Author Index, Volume 122, No. 3

Allmann, D. W., 766
Anderson, Laurens, 529
Argaman, M., 621

Barnard, Eric A., 699, 714
Benko, Paul V., 783
Beyer, Robert E., 614

Cammer, Wendy, 721, 735
Canessa-Fischer, M., 658
Ciment, D. M., 563
Clark, Lee, 807
Cox, Rody P., 552

Dacus, David M., 599
Doi, Roy H., 685
Doolittle, R. F., 674
Douglas, H. C., 810
Duckett, William D., 591

Estabrook, Ronald W., 721, 735

Felton, S. P., 810
Finkelstein, James D., 583

Green, D. E., 766
Griffin, Martin J., 552

Harris, R. A., 766
Helbock, Harold, 807
Henderson, Rogene F., 599
Henderson, Thomas R., 599
Hofstee, B. H. J., 574
Horikoshi, Koki, 685
Hutton, John J., Jr., 805

Jackson, L. J., 605
Johnson, Morris A., 537

Kim, Yoon Soo, 644
Koide, S. S., 670

Lambooy, John P., 644
Lee, Yong, 635

Mackler, Bruce, 810
Marglin, Arnold, 748
Markert, Clement L., 753
McMenamy, Rapier H., 635
Meizel, Stanley, 753
Merrifield, R. B., 748
Morgan, Sallye, 591
Morrison, George R., 569
Mostafa, Sohair Abdel-Aziz, 694
Mross, G. A., 674

Overend, W. G., 563

Palmer, Graham, 810
Paul, Inge, 653

Rafter, Gale, W. 648
Razin, S., 621
Remmert, LeMar F., 537
Rhoads, Robert E., 805
Riveros-Moreno, V., 658
Rodwell, A. W., 621
Rosenfeld, R. S., 653
Rottem, S., 621

Sacks, Jacob, 591
Saltman, Paul, 807
Santoro, T., 664
Seaman, G. V. F., 605
Segal, Irwin H., 783
Schaefer, Margaret, 591
Sharp, Charles W., 810
Smith, Elnora H., 614
Stotzky, G., 664
Sunaga, Kiyoshi, 670

Udenfriend, Sidney, 805
Uhlenbruck, G., 605
Umbreit, W. W., 694

Wang, Tung-Yue, 629
Weinhold, Paul A., 529
Winterberg, F., 594
Wood, Trudy C., 783

Yamauchi, Tatsuo, 653

Zambrano, F., 658
Zendzian, Esther N., 699, 714

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2. Rosalki, S. B., & Wilkinson, J. H., "Serum α-Hydroxybutyric Dehydrogenase in Diagnosis", JAMA, **185**, 61, (1964).
3. Preston, J. A., Batsakis, J. G., & Briere, R. O., "Serum α-Hydroxybutyric Dehydrogenase", Amer. J. Clin. Path., **41**, 237, (1964).
4. Elliott, B. A., & Wilkinson, J. H., "Relative Efficiencies of Some Serum Enzyme Tests in the Diagnosis of Myocardial Infarction", Lancet, **1**, 71, (1962).

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